

APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

SLO-KSC 2007-002

TITLE

SCA Orbiter Attach Point Measuring/Adjusting on SCA 905 and 911 at DFRC.

DOCUMENT

NUMBER/TITLE

(OHE PR) MV0-074A-1-0593 Suspect SCA Attach Point Locations.

(OPTICS TPS) SS25A-668 SCA Alignment at DFRF.

PREPARED BY

Andrew Layne

DATE

02/26/2007

REQUIRED APPROVAL

CONTRACTOR

DESIGN

R & QA

OPERATIONS

SAFETY




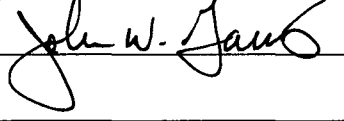
NASA

DESIGN


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OPERATION: Shuttle Carrier Aircraft (SCA) Orbiter attach point measurement and adjustment at Dryden Flight Research Center (DFRC)

SUPPORTING DOCUMENTS: The associated procedural documentation and systems assurance analyses are as follows:

1. PR MV0-074A-1-0593 Suspect SCA attach point locations.
2. OPTICS TPS SS25A-668 SCA alignment at DFRF.
3. SAA290M01-001, Systems Assurance Analysis for the 55 Ton Main Hoists, Access Service Platform Hoists and the Wind Restraint Mechanism on the Mate/Demate Device at the Shuttle Landing Facility - KSC (SLF) and SLS-1 (DFRC).

GENERAL DESCRIPTION: This operation is a one-time occurrence involving measuring/adjusting the locations of the Orbiter attach points on top of the SCA using laser optic equipment mounted on the Mate/Demate Device (MDD) at DFRC. The SCA will be under the suspended H70-0743 Orbiter Sling. An engineering review of this operation has been conducted. This work has resulted in hardware and/or procedure modifications that minimize the exposure of employees to working under suspended loads. Due to the uniqueness of the activity and the limitations using present systems, hardware, and facilities, there remain some tasks where suspended load operations are required under specifically approved and controlled conditions. This operation requires a minimum number of personnel under the load to perform the following tasks:

1. Sweep the apron area under the suspended H70-0743 orbiter ferry flight lifting sling to remove foreign object debris (1 person - 5 minutes).
2. Tow/spot SCA into the MDD passing under the suspended H70-0743 orbiter ferry flight lifting sling (3 personnel - 20 minutes).
3. Take optics measurements/make adjustments to the (3) Orbiter attach points on top of the SCA while under the suspended H70-0743 orbiter ferry flight lifting sling (4 personnel – 8 shifts).

RATIONALE/ANALYSIS: The suspended load tasks comply with the NASA Alternate Safety Standard for Suspended Load Operations as follows:

Alternate Standard Requirement #1a: SCA Orbiter attach point measuring/adjusting operations at the MDD at DFRC cannot be conducted without personnel beneath the suspended load. The tasks performed under the load have been analyzed and evaluated with the determination no feasible

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engineering design or procedural options are readily available to eliminate the suspended load operation. Redesign options of the MDD were suggested to allow hard points at particular levels. The design options added uncertainty whether the hard points would be able to be disengaged properly from the orbiter which would affect the safety and integrity of the orbiter. In addition, these design alternatives would pose other risks for personnel working at heights.

Alternate Standard Requirement #1b: Secondary support systems to assume support of (catch) the load were evaluated and were not feasible for this operation. Design criteria was too cumbersome to prevent the orbiter sling from being a suspended load and also prevented access to areas of critical work that needed to be performed.

Alternate Standard Requirement #1c: The number of personnel allowed under the suspended load for each task is as stated in the General Description. These personnel are also identified with safety vests to annotate the required personnel for the operation.

Alternate Standard Requirement #1d: Personnel will accomplish the required suspended load tasks as quickly and safely as possible to minimize time exposure; see General Description.

Alternate Standard Requirement #2: Suspended load operations are reviewed and approved on a case-by-case/specific need basis - see General Description and Alternate Standard Requirement #1.

Alternate Standard Requirement #3: Only those suspended load operations approved by the NASA Safety and Mission Assurance Division Chief will be permitted. A list of approved suspended load operations will be maintained by the NASA Safety and Mission Assurance Division.

Alternate Standard Requirement #4: PR MV0-074A-1-0593 and TPSB SS25A-668 are written to allow only required personnel under the suspended load. These work documents will be available on site for inspection during the operation.

Alternate Standard Requirement #5: A new suspended load operation not covered by this SLOAA, deemed necessary due to unusual or unforeseen circumstances where real time action is required, shall be documented and approved by the NASA Safety and Mission Assurance Division Chief.

Alternate Standard Requirement #6: The three 55 ton hoists at the MDD are designed, tested, inspected, maintained, and operated in accordance with the

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NASA Safety Standard for Lifting Devices and Equipment, NASA-STD-8719.9. The hoists are designed to a minimum safety factor of 5 (based on the ultimate yield strength) for the hoist load-bearing components. The H70-0743 orbiter lifting sling is designed with a safety factor of 5 against ultimate strength and a safety factor of 3 against yield.

The hoists are equipped with two holding brakes and an emergency overspeed brake, each capable of holding the hoist rated capacity.

The hoists were one-time proofloaded at 125 percent of rated capacity, are load tested annually at 100 percent of rated capacity, and have a monthly, quarterly, semiannual and annual preventive maintenance program to ensure proper operation.

The wire rope is inspected monthly for discrepancies. Nondestructive testing of the hoist hooks is performed annually.

When performing the measuring/adjusting operation, one hoist is connected to the forward attach point of the H70-0743 orbiter lifting sling and two hoists are connected to the aft attach points. The orbiter lifting sling weighs approximately 26,000 pounds. The hoists and Orbiter sling remain static during the entire operation.

Alternate Standard Requirement #7: A System Assurance Analysis (SAA) has been completed on the 55 ton hoists at the MDD. The SAA includes a Failure Modes and Effects Analysis/Critical Item List (FMEA/CIL) and a hazard analysis (see Supporting Documents). The SAA identifies no single failure points for the MDD 55 ton hoists.

Alternate Standard Requirement #8: Visual inspections for cracks or other signs of damage or anomalies are performed on the hoist hooks and lifting sling assembly along with crane functional checks prior to each operation per NASA-STD-8719.9.

Alternate Standard Requirement #9: **N/A.** The hoists will be locked-out and not manned. The hoists and Orbiter sling remain static during the entire operation.

Alternate Standard Requirement #10: Appropriate control areas are established and maintained prior to and during the operation. Only required personnel (man loaded in the procedure) are permitted in this area.

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Alternate Standard Requirement #11: Personnel are briefed just prior to performing the task about the hazard involving the suspended load. A pretask briefing and a safety walkdown of the area are conducted prior to the lift to ensure all systems and personnel are ready to support. All participants are instructed on their specific tasks and warned of the hazards involved. Following any crew change, new personnel are instructed by the task leader on their specific tasks and warned of the hazards involved.

Alternate Standard Requirement #12: N/A. Since the hoists will be locked-out and not manned, communication is not possible, or necessary, between the operator(s), the signal person(s) and the person(s) working under the suspended load.

Alternate Standard Requirement #13: N/A. Since the hoists will be locked-out and not manned, personnel working beneath the suspended load cannot remain in continuous sight of the operator and/or signal person, nor is it necessary.

Alternate Standard Requirement #14: The NASA Safety and Mission Assurance Division shall conduct periodic reviews to ensure the continued safety of suspended load procedures.

Alternate Standard Requirement #15: The NASA Safety and Mission Assurance Division will provide copies of approved SLOAAs, a list of approved suspended load operations, a list of cranes/hoists used for suspended load operations and copies of the associated FMEA/CIL and hazards analyses to NASA Headquarters.

APPROVAL:

DATE:

 2-26-07

Launa Maier

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